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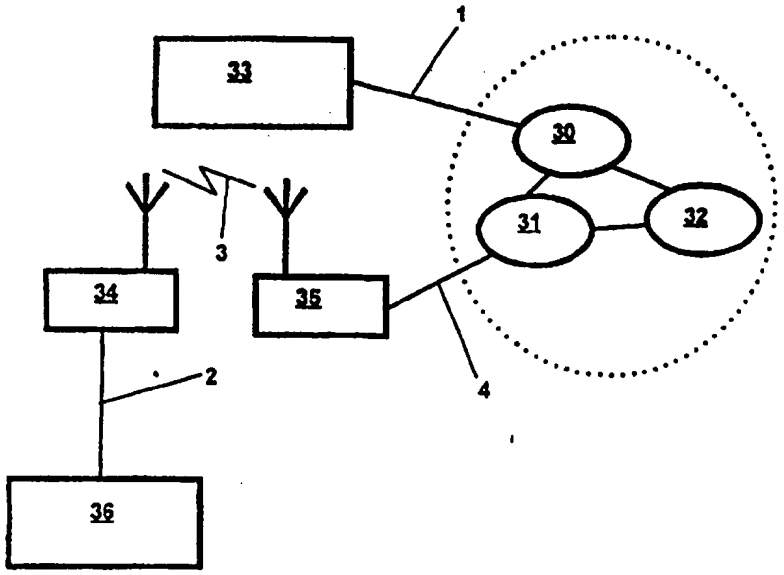

(57) Abstract

A telecommunications system has an ATM-network and at least one radio link. A subscriber equipment can be connected to said ATM link by an ATM-adapted radio modem. The subscriber equipment includes an ATM-card containing an ATM-layer and an AAL-layer. The ATM-adapted radio modem has a mobile part and a fixed part. The mobile part is linked to a subscriber equipment by a UNI-interface. The fixed part is linked to an ATM-node, of an ATM network, by a UNI-interface, and is physically located in a radio base station. The subscriber apparatus is adapted for connection, either to said ATM-adapted radio modem, or directly to said ATM network, by a fixed link. Complete AAL-PDUs for traffic routed via said ATM-adapted radio modem are not created in the ATM-adapted radio modem.

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Improvements in, or Relating to, ATM Transmission by Radio

The present invention relates to a telecommunications system which includes an ATM-network and radio transmission links, a method for establishing radio access to an ATM-network and an ATM-adapted radio modem.

The increasing use of asynchronous transfer mode transmission systems means that there is a clear need to provide for a rapid and simple method for establishing radio access to ATM-networks. Ideally, it should be possible to use the same equipment for both fixed access and radio access, to an ATM-network.

Asynchronous Transfer Mode, ATM, is a method of transporting user and signalling information in fixed length cells. ATM is a key technology for the development of broadband systems. It provides a focal point for convergence between different services and different transmission systems and the form in which information will be switched and routed in multi-service networks.

ATM is already in use as a system for multiplexing in private networks, and various ATM multiplexers and routers are already available.

ATM operates at a sub-layer of OSI layer 2, called the ATM layer, and provides connection orientated virtual connections between two points. An ATM layer connection consists of a concatenation of ATM layer links used to provide an end-to-end connection. The ATM virtual connection is identified at the ATM layer by a combination of a Virtual Path Identifier and a Virtual

Channel Identifier. Above the ATM layer, there is an ATM Adaptation Layer, AAL, that relates the virtual connection to the network service that is being carried. It may relate the ATM layer virtual connection to the network connection between terminals at network access points, e.g. exchange lines identified by ITU-T E.164 numbers. Signalling and user information from the network layer will normally be carried on separate virtual connections at the ATM layer.

With ATM, the information is carried in fixed length cells, the number of such cells per unit of time reflecting the bandwidth requirement of the user, and variations in their arrival rate reflecting the bursty nature of the traffic. The number of cells may correspond to sub-multiples, or multiples, of 64 kbit/s channels, or may correspond to an essentially random process, e.g. packets in transaction processing.

The ATM structure is described in ITU-T recommendation I.361. An ATM cell consists of 53 octets and is divided into a header of 5 octets and an information field of 48 octets. The primary purpose of the header is to identify the connection number for the sequence of cells that constitute a virtual channel for a specific call. A number of virtual paths, multiplexed at the ATM layer, may be connected into the same physical layer with each path being identified by a Virtual Path Identifier, VPI, of 8 bits at the user-network interface and 12 bits at the network-node interface. A number of channels may exist within each path with each being identified by a Virtual Channel Identifier, VCI, of 16 bits.

The combination of VPI and VCI is unique. Values of VCI may be re-used in different virtual paths. The header also contains header error control, generic flow

control, cell loss priority and payload type fields.

SDH may be used to provide the physical layer for the transmission of ATM cells. Because the SDH container capacity may not be an integer multiple of the ATM cell length, cells are allowed to cross container boundaries. In order to provide security against false cell delineation and the possibility of the information field replicating the STM-N frame alignment word, the cell information field, (but not the header), is scrambled before mapping into the container.

The ATM Adaptation Layer, AAL, maps user and signalling information into ATM cells. The ATM Adaptation Layer is itself divided into two sub-layers:

- the AAL Convergence Sub-layer, which consists of a common part and a service specific part and interfaces between the particular services supported and a Segmentation and Re-assembly Sub-layer; and

- the Segmentation and Re-assembly Sub-layer (SAR), which carries out the conversion to, and from, the ATM cells and may provide error detection and multiplexing - there are different types of SAR for different service types.

The AAL Adaptation Layer communicates with its peer layer through the use of headers and other information that is carried in the payload part of the ATM cell.

The ITU-T has defined two physical interfaces to ATM. one based on SDH, and the other on a version of Asynchronous Time Division (ATD) consisting of an unframed concatenation of ATM cells. At the user-

network interface the rate in both cases is 155.520 Mbit/s.

It is an object of the present invention to provide a telecommunications system in which a subscriber apparatus can be used for both fixed access to an ATM-network and radio access to an ATM network.

It is a further object of the present invention to provide a method for establishing radio access to an ATM network.

It is a yet further object of the present invention to provide a telecommunications system having at least one radio link and an ATM-network, in which it is possible to establish fixed and radio access to the ATM-network from the same subscriber apparatus.

It is a still further object of the present invention to provide an ATM-adapted radio modem which can be used to establish a radio connection between a subscriber apparatus and an ATM network.

According to a first aspect of the present invention, there is provided a telecommunications system, having an ATM-network and at least one radio link, characterised in that a subscriber equipment is connected to said ATM link by an ATM-adapted radio modem, said subscriber equipment including an ATM-card containing an ATM-layer and a AAL-layer.

Said ATM-adapted radio modem may have a mobile part and a fixed part.

Said mobile part may be linked to said subscriber equipment by a UNI-interface.

Said fixed part may be linked to an ATM-node, of said ATM network, by a UNI-interface, and said fixed part may be located in a radio base station.

Said subscriber apparatus may be adapted for connection, either to said ATM-adapted radio modem, or directly to said ATM network, by a fixed link.

Complete AAL-PDUs for traffic routed via said ATM-adapted radio modem may not be created in said ATM-adapted radio modem.

According to a second aspect of the present invention, there is provided a temporary ATM link to a fixed ATM network, characterised in that said temporary link is established by means of a telecommunications system as set forth in the previous paragraphs.

According to a third aspect of the present invention, there is provided a mobile ATM-connection, characterised in that said mobile ATM-connection is established by means of a telecommunications system as set forth in the previous paragraphs.

According to a fourth aspect of the present invention there is provided a remote controlled robot, characterised in that communication between said robot and a remote location is established by means of a telecommunications system as set forth in the previous paragraphs.

According to a fifth aspect of the present invention, there is provided a public transport system for the conveyance of passengers, characterised in that a plurality of ATM access terminals are provided for use of said passengers, said plurality of ATM access terminals connected to a telecommunications system as

set forth in the previous paragraphs.

According to a sixth aspect of the present invention, there is provided an ATM-adapted radio modem, for use with a telecommunications system as set forth in the previous paragraphs, characterised in that said ATM-adapted radio modem has a mobile part and a fixed part.

Said mobile part may be linked to a subscriber equipment by a UNI-interface.

Said fixed part may be linked to an ATM-node of an ATM network by a UNI-interface, said fixed part being located in a radio base station.

Said ATM-adapted radio modem may be arranged to identify different types of telecommunications traffic and optimise traffic management in dependence on traffic type.

Said ATM-adapted radio modem may be adapted to determine traffic type by identifying a VCI-value in an ATM-header.

Said ATM-adapted radio modem may be adapted to vary channel encoding and/or interleaving in dependence on traffic type.

Said ATM-adapted radio modem may be so arranged that telecommunications traffic, transmitted via an AAL-layer in said subscriber equipment, is not transmitted via an AAL-layer in said ATM-adapted radio modem.

Said ATM-adapted radio modem may be so arranged that said AAL-layer, in said ATM-adapted radio modem, is only used for transmission of signalling and/or control data whose transmission path terminates at said ATM-

adapted radio modem.

Said ATM-adapted radio modem may have an internal interface, parallel to said UNI-interface, via which control signals originating from either said subscriber equipment, or said ATM network, are transmiited to the mobile part of said ATM-adapted radio modem.

Said ATM-adapted radio modem may be arranged so that complete AAL-PDUs are not created in said ATM-adapted radio modem for traffic which does not originate in said ATM-adapted radio modem.

According to a seventh aspect of the present invention, there is provided a method of transmitting ATM traffic from a subscriber apparatus to an ATM-network over a radio link, characterised in that said subscriber traffic is transmitted via an ATM-adapted radio modem having a mobile part connected to said subscriber apparatus and a fixed part connected to said ATM-network.

Traffic may be transmitted from said subscriber apparatus to said mobile part via a UNI-interface.

Said ATM-adapted radio modem may identify said traffic by type, e.g. audio, video, or data, and optimises traffic management to that traffic type.

Said ATM-adapted radio modem may determine traffic type by identifying a VCI-value in an ATM-header.

Said ATM-adapted radio modem may vary channel encoding and/or interleaving in dependence of traffic type.

Telecommunications traffic that is transmitted via

the AAL-layer in said subscriber equipment may not be transmitted via an AAL-layer in said ATM-adapted radio modem.

Said AAL-layer in said ATM-adapted radio modem may be used only for transmission of signalling and/or control data whose transmission path terminates at said ATM-adapted radio modem.

Said ATM-adapted radio modem may have an internal interface, parallel to said UNI-interface, via which the mobile part of said ATM-adapted radio modem can be controlled from either said subscriber equipment, or said ATM network.

Complete AAL-PDUs may not be created in said ATM-adapted radio modem for traffic originating from outside said ATM-adapated radio modem.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 illustrates a telecommunications system including an ATM-network and a radio link.

Figure 2 illustrates the radio link, shown in Figure 1, in greater detail.

To facilitate an understanding of the present invention, a glossary of some of the abbreviations used with reference to ATM transmission and radio mobile telecommunications services are set out below:

AAL: ATM Adaption Layer

ATM: Asynchronous Transfer Mode

BS: Base Station

BSA: Basic Service Area

BSS: Basic Service Set

IP: Internet Protocol

LAN: Local Area Network

MT: Mobile Terminal

MVD: MT pair-VCC mapping Database

NNI: Network Node Interface

PDU: Protocol Data Unit

SRD: ATM Switch Routing Database

SVC: Switched Virtual Connection

UNI: User Node Interface

VC: Virtual Channel

VCC: Virtual Channel Connection

VCI: Virtual Channel Indicator

VLAN: Virtual Local Area Network

VPI: Virtual Path Indicator

WAN: Wide Area Network

Referring now to Figure 1, there is shown an ATM-

network having ATM-nodes, 30, 31 and 32. A subscriber apparatus, 33 is connected to ATM-node 30, via a fixed link and UNI-interface, 1. A subscriber apparatus, 36, is connected to an ATM-adapted radio modem having a mobile part 34, and a fixed part, 36, located in a radio base station. The subscriber apparatus is linked to ATM-adapted radio modem, 34, 35, by a UNI-interface, 2. The fixed part of the ATM-adapted radio modem, 35, is connected to ATM-node, 31, by a UNI-interface 4. The mobile, 34, and fixed, 35, parts of the ATM adapted radio modem are linked by radio link 3.

Referring now to Figure 2, a subscriber apparatus 20, corresponding to 36 in Figure 1, is connected to the mobile part of an ATM-adapted radio modem 21, corresponding to 34 in Figure 1. The fixed part of the ATM-adapted radio modem, 22, corresponding to 35 in Figure 1, is connected to an ATM network via a UNI-interface 23. The subscriber apparatus, 20, may have sources of different types of traffic, 5, 6, and 7. The traffic components originating from 5, 6, and 7 are video, audio and data, respectively. Signalling traffic, 8, may also originate from subscriber apparatus 20. The subscriber apparatus has an ATM-card equipped with an AAL-layer 9, and an ATM-layer 10. The subscriber apparatus 20, is linked to the mobile part of the ATM-adapted radio modem, 21, via a UNI-interface between ATM-layer 10, in subscriber apparatus 20, and ATM-layer 13, in the ATM-adapted radio modem. The mobile part of the ATM-adapted radio modem has an AAL-layer 12, which may be used for processing signalling traffic, 11, originating from, or directed to, the fixed part of the ATM-adapted radio modem. The ATM-layer, 13, links directly to a radio modem 14. It should be noted that traffic originating from subscriber apparatus 20, is not processed by the AAL-layer 12.

The mobile part of the ATM-adapted radio modem, 22, has a radio modem 15, linked to an ATM-layer 18. An AAL-layer 17, is provided for processing signalling traffic, 16.

For a subscriber equipment 33, to communicate via an ATM-network, having ATM nodes, 30, 31 and 32, it must include an ATM-card containing an ATM-layer 9, and an AAL-layer 10, see both Figure 2 and Figure 1. The ATM card may be connected by means of a fixed connection, for example an optical fibre link, to the ATM network via a UNI-interface, 1. The UNI-interface, 1, defines the signals which control the subscriber's access to the ATM network.

Where radio access to the ATM-network is required, the subscriber equipment can be connected to an ATM card 12, 13, via a UNI-interface 30, see Figure 2. In Figure 1, this is illustrated as a connection between subscriber equipment 36, and a radio modem 34, via a UNI interface 2. In Figure 2, the ATM-card is an integral part of the mobile part of an ATM-adapted radio modem 21, which comprises the ATM-card 12, 13 and modem 14. The ATM-card comprises an AAL-layer, 12 and an ATM-layer, 13. The links, 27, 28 and 29, between the ATM layer and the modem 14 are adapted to handle video, audio and data traffic.

The mobile part of the ATM-adapted radio modem, 34, provides a link between mobile subscriber apparatus, 36 and a base station part of the ATM-adapted radio modem, 35, see Figure 1. The two parts of the radio modem communicate over a radio link 3.

The base station part of the radio modem can be thought of as a reflected image of the mobile part. This means that the base station part of the radio

modem, 35, communicates with a node, 31, in the ATM network, by means of a UNI-interface 4. This enables the base station part of the radio modem to be connected to the ATM network in the same manner as any other subscriber equipment.

The data flow generated by a subscriber equipment may contain a variety of application components, e.g. video, 5, audio, 6 and data 7, see Figure 2. This data flow will enter the ATM-adapted radio modem as a stream of ATM-cells. The ATM-header will enable the identification of the application component which has generated the data content of a particular ATM-cell by means of a VCI-value contained in the header. When a connection is first established, the subscriber equipment identifies the application component, i.e. the type of traffic, to the ATM-adapted modem, by means of the VCI-value corresponding to the particular application component employed. This enables the radio modem to optimise the management of different types of traffic, depending on application type. This may be realised by using different types of channel encoding and interleaving in the radio modem, 14, 15, see Figure 2. It should be noted that the term radio modem as used herein may refer to the combination of modems 14, and 15 at each end of the radio link. For example, where traffic originates from an application component that has a low real time requirement, e.g. data, retransmission over the radio channel can be used when an error, introduced by the radio link, is detected.

It should be noted that information which has been generated by, or is destined for, different application components, and is transmitted via an AAL-layer in the subscriber equipment 9, will not be transmitted via AAL-layers, 12 and 17, in the ATM-adapted radio modem. The information content of the ATM-cells (48 octets) will be

forwarded directly to the radio modem part 14, 15. Here channel encoding and interleaving of the information will be performed before it is transmitted over the radio link. Since complete AAL-PDUs need not be recreated in the ATM adapted radio modem 12, 17, the processing of transmitted information is minimised. This, in turn, means that no unnecessary delays are introduced.

The AAL-layer in the ATM-adapted radio modem 12, 17, is only used for information which terminates there, for example, control signals between the subscriber terminal, e.g. from 8, and the ATM-adapted radio modem 11, or control signals between the base station part of the ATM-adapted radio modem 16, and the control and supervisory functions in the ATM network.

Thus, in parallel with the UNI-interface there will be an internal interface, via which the mobile part of the radio modem and its base station can be controlled from subscriber equipment, and/or from the network operator.

The present invention can be used in a number of ways, examples of these applications are set out below.

a. To provide radio access from a company's premises to a fixed ATM-network while preparations are made for the installation of a fixed link.

b. To provide a mobile ATM-connection within an industrial area.

c. To provide a communications link for operational control, via an ATM-network, of a remotely controlled robot, having a TV-camera and claw clutches. Such an arrangement enables a remotely

located expert to control the robot, permitting improved response times. Equipment of this type can be used in hazardous environments, such as nuclear power stations, or for carrying out dangerous tasks, e.g. disarming bombs.

d. The mobile part of an ATM-adapted radio modem, according to the present invention, can have a number of subscriber equipments connected to it. For example, such a system could be fitted to a railway train enabling travellers to plug equipment into sockets provided in the vicinity of their seats. This would enable effective communication links to be established between a rail passenger and the outside world.

CLAIMS

1. A telecommunications system, having an ATM-network and at least one radio link, characterised in that a subscriber equipment is connected to said ATM link by an ATM-adapted radio modem, said subscriber equipment including an ATM-card containing an ATM-layer and a AAL-layer.

2. A telecommunications system, as claimed in claim 1, characterised in that said ATM-adapted radio modem has a mobile part and a fixed part.

3. A telecommunications system, as claimed in claim 2, characterised in that said mobile part is linked to said subscriber equipment by a UNI-interface.

4. A telecommunications system, as claimed in either claim 2, or claim 3, characterised in that said fixed part is linked to an ATM-node, of said ATM network, by a UNI-interface, said fixed part being located in a radio base station.

5. A telecommunications system, as claimed in any previous claim characterised in that said subscriber apparatus is adapted for connection, either to said ATM-adapted radio modem, or directly to said ATM network, by a fixed link.

6. A telecommunications system, as claimed in any previous claim, characterised in that said ATM-adapted radio modem is arranged to identify different types of telecommunications traffic and to optimise traffic management in dependence on traffic type.

7. A telecommunications system, as claimed 6,

characterised in that said ATM-adapted radio modem is adapted to determine traffic type by identifying a VCI-value in an ATM-header.

8. A telecommunications system, as claimed in claim 6, or 7, characterised in that said ATM-adapted radio modem is adapted to vary channel encoding and/or interleaving in dependence on traffic type.

9. A telecommunications system, as claimed in any previous claim, characterised in that said ATM-adapted radio modem is arranged so that telecommunications traffic, transmitted via the AAL-layer in said subscriber equipment, is not transmitted via an AAL-layer in said ATM-adapted radio modem.

10. A telecommunications system, as claimed in any previous claim, characterised in that said AAL-layer in said ATM-adapted radio modem is used only for transmission of signalling and/or control data whose transmission path terminates at said ATM-adapted radio modem.

11. A telecommunications system, as claimed in claim 10, characterised in that said ATM-adapted radio modem has an internal interface parallel to said UNI-interface via which the mobile part of said ATM-adapted radio modem can be controlled from either said subscriber equipment, or said ATM network.

12. A telecommunications system, as claimed in any previous claim, characterised in that complete AAL-PDUs for traffic routed via said ATM-adapted radio modem are not created in said ATM-adapted radio modem.

13. A temporary ATM link to a fixed ATM network, characterised in that said temporary link is established

by means of a telecommunications system as claimed in any of claims 1 to 12.

14. A mobile ATM-connection, characterised in that said mobile ATM-connection is established by means of a telecommunications system as claimed in any of claims 1 to 12.

15. A remote controlled robot, characterised in that communication between said robot and a remote location is established by means of a telecommunications system as claimed in any of claims 1 to 12.

16. A public transport system for the conveyance of passengers, characterised in that a plurality of ATM access terminals are provided for use of said passengers, said plurality of ATM access terminals being connected to a telecommunications system as claimed in any of claims 1 to 12.

17. An ATM-adapted radio modem, for use with a telecommunications system as claimed in any of claims 1 to 12, characterised in that said ATM-adapted radio modem has a mobile part and a fixed part.

18. An ATM-adapted radio modem, as claimed in claim 17, characterised in that said mobile part is linked to a subscriber equipment by a UNI-interface.

19. An ATM-adapted radio modem, as claimed in either claim 17, or claim 18, characterised in that said fixed part is linked to an ATM-node of an ATM network by a UNI-interface, said fixed part being located in a radio base station.

20. An ATM-adapted radio modem, as claimed in any of claims 17 to 19, characterised in that said ATM-adapted

radio modem is arranged to identify different types of telecommunications traffic and optimise traffic management in dependence on traffic type.

21. An ATM-adapted radio modem, as claimed 20, characterised in that said ATM-adapted radio modem is adapted to determine traffic type by identifying a VCI-value in an ATM-header.

22. An ATM-adapted radio modem, as claimed in claim 20, or 21, characterised in that said ATM-adapted radio modem is adapted to vary channel encoding and/or interleaving in dependence on traffic type.

23. An ATM-adapted radio modem, as claimed in any of claims 17 to 22, characterised in that said ATM-adapted radio modem is so arranged that telecommunications traffic, transmitted via an AAL-layer in said subscriber equipment, is not transmitted via an AAL-layer in said ATM-adapted radio modem.

24. An ATM-adapted radio modem, as claimed in any of claims 17 to 23, characterised in that said ATM-adapted radio modem is so arranged that said AAL-layer, in said ATM-adapted radio modem, is only used for transmission of signalling and/or control data whose transmission path terminates at said ATM-adapted radio modem.

25. An ATM-adapted radio modem, as claimed in claim 24, characterised in that said ATM-adapted radio modem has an internal interface, parallel to said UNI-interface, via which control signals originating from either said subscriber equipment, or said ATM network, are transmiited to the mobile part of said ATM-adapted radio modem.

26. An ATM-adapted radio modem, as claimed in any of

claims 17 to 23, characterised in that said ATM-adapted radio modem is arranged so that complete AAL-PDUs are not created in said ATM-adapted radio modem for traffic which does not originate in said ATM-adapted radio modem.

27. A method of transmitting ATM traffic from a subscriber apparatus to an ATM-network over a radio link, characterised in that said subscriber traffic is transmitted via an ATM-adapted radio modem having a mobile part connected to said subscriber apparatus and a fixed part connected to said ATM-network.

28. A method, as claimed in claim 27, characterised in that traffic is transmitted from said subscriber apparatus to said mobile part via a UNI-interface.

29. A method, as claimed in either claim 27, or claim 28, characterised in that said fixed part is located in a radio base station and traffic is transmitted from said fixed part to said ATM-network via a UNI-interface.

30. A method, as claimed in any of claims 27 to 29, characterised in that said ATM-adapted radio modem identifies said traffic by type, e.g. audio, video, or data, and optimises traffic management to that traffic type.

31. A method, as claimed in claim 30, characterised in that said ATM-adapted radio modem determines traffic type by identifying a VCI-value in an ATM-header.

32. A method, as claimed in claim 30, or 31, characterised in that said ATM-adapted radio modem varies channel encoding and/or interleaving in dependence of traffic type.

33. A method, as claimed in any of claims 27 to 31, characterised in that telecommunications traffic that is transmitted via the AAL-layer in said subscriber equipment is not transmitted via an AAL-layer in said ATM-adapted radio modem.

34. A method, as claimed in any of claims 27 to 32, characterised in that said AAL-layer in said ATM-adapted radio modem is used only for transmission of signalling and/or control data whose transmission path terminates at said ATM-adapted radio modem.

35. A method, as claimed in claim 34, characterised in that said ATM-adapted radio modem has an internal interface, parallel to said UNI-interface, via which the mobile part of said ATM-adapted radio modem can be controlled from either said subscriber equipment, or said ATM network.

36. A method, as claimed in any of claims 27 to 35, characterised in that complete AAL-PDUs are not created in said ATM-adapted radio modem for traffic originating from outside said ATM-adapated radio modem.

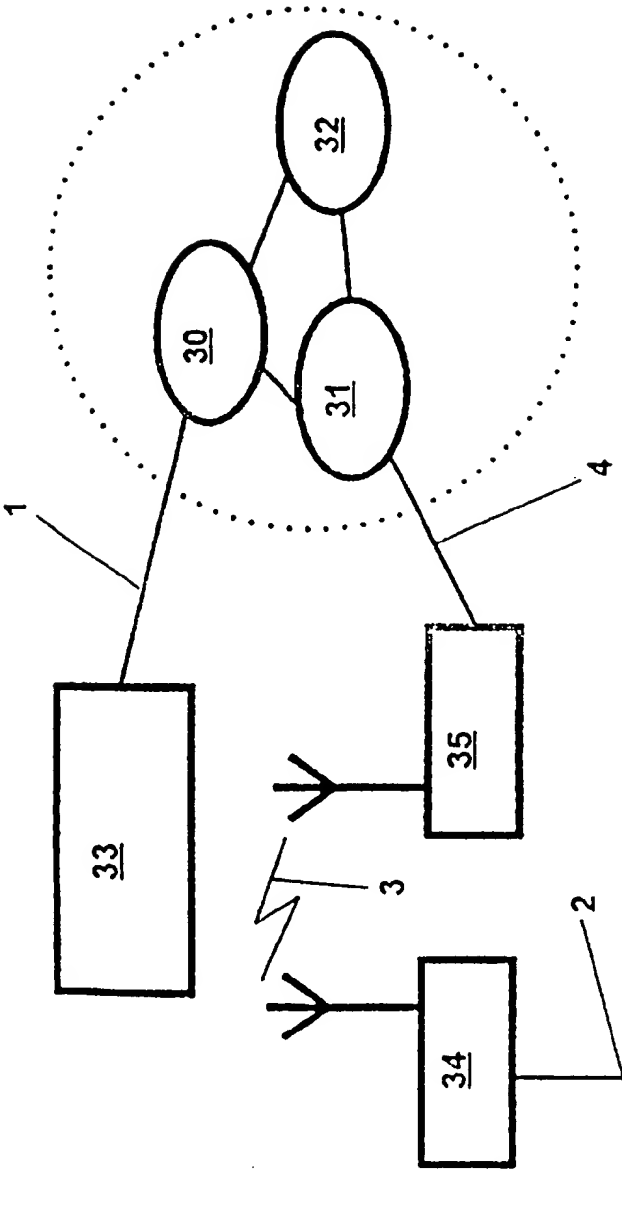

FIGURE 1

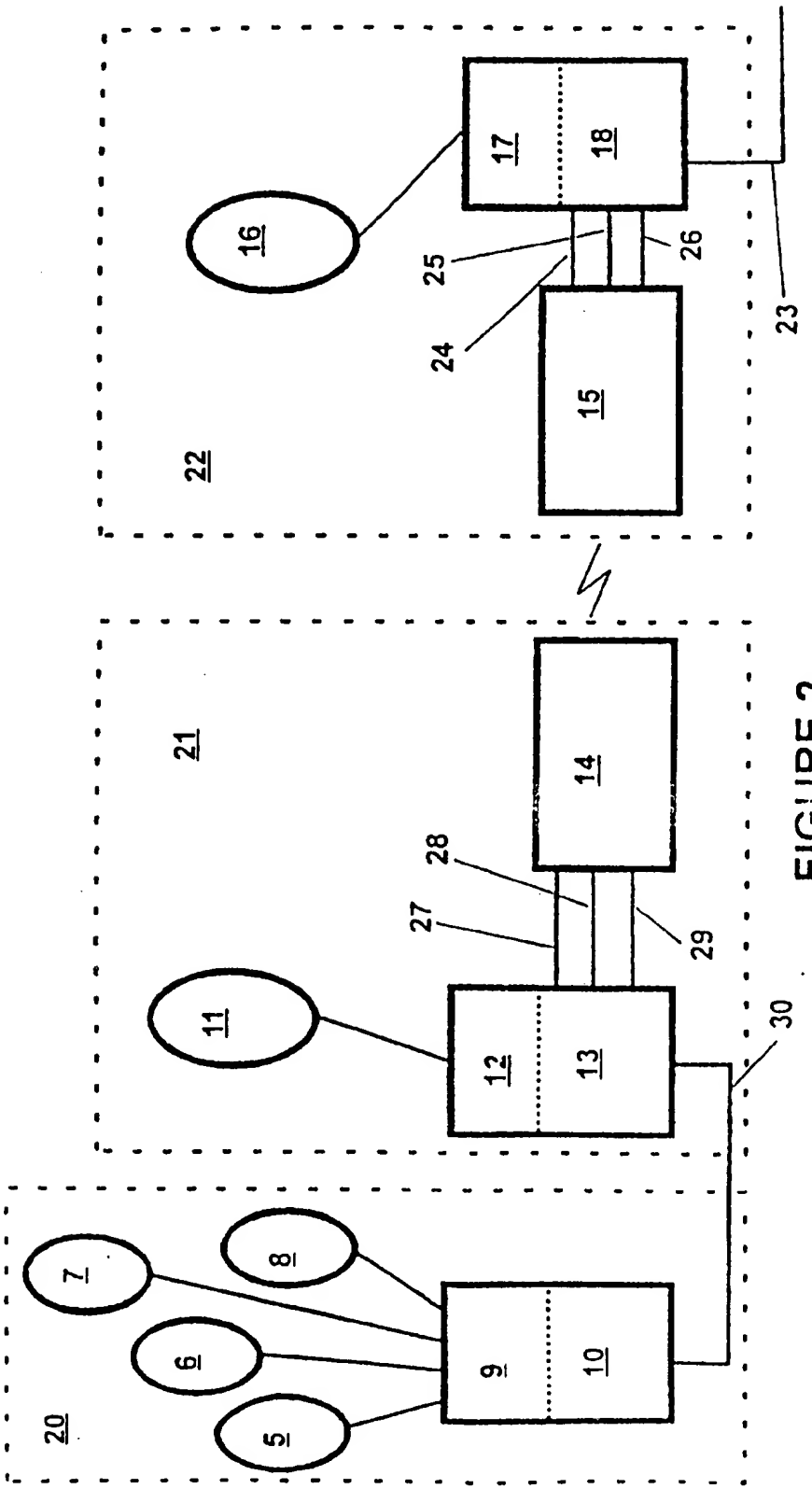

FIGURE 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00868

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/24
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0700225 A2 (AT&T CORP.), 6 March 1993 (06.03.93), see the whole document	1-4,6-8,11, 17-22,25, 27-32,35
Y		9,10,23,24, 33,34
	--	
X	WO 9319559 A1 (ROKE MANOR RESEARCH LIMITED), 30 Sept 1993 (30.09.93), page 2, line 7 - line 24; page 3, line 14 - line 24; page 4, line 11 - line 18, abstract	1-6,17-20, 27-31
Y		9,10,23,24, 33,34
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"B" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
7 November 1997	12 -11- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Peter Hedman Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00868

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	David E. Mcdysan, Darren L. Spohn "ATM Theory and application" 1994 McGraw-Hill, Inc. ISBN 0-07-060362-6 see page 229-231, 237-240 -- --------	9,10,23,24, 33,34

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00868

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 12,26,36
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

In claims 12,26,36 it is stated that AAL-PDU'S are not created in a ATM-adapted radio modem. However, neither in the claims, nor in the description AAL-PDU'S are further described. It is therefore unclear how the invention in accordance with claims 12,26 or 36 is supposed to be carried out.

3. ☒ Claims Nos.: 13-16
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/10/97

International application No.
PCT/SE 97/00868

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0700225 A2	06/03/93	JP 8079838 A	22/03/96
		US 5600707 A	04/02/97
WO 9319559 A1	30/09/93	EP 0592623 A	20/04/94
		GB 2265278 A,B	22/09/93
		FI 932934 D	00/00/00
		NO 932345 A	27/12/93